Mid-Term Report: Assessment of the operational potential of assimilating IASI L2 in a regional model

Bruna Silveira V. Guidard,N. Fourrié

EUMETSAT study EUM/CO/17/4600001975/TA

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- 2 Definition of data assimilation experiments
- **3** Results of data assimilation experiments
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Review

AROME

Characteristics:

- Horizontal Resolution \Rightarrow 1.3 km;
- Vertical Resolution \Rightarrow 90 levels (10 hPa top);
- Assimilation Scheme ⇒ 3D-Var (1 hour assimilation cycle and 1 hour window);
- Boundary conditions \Rightarrow ARPEGE;
- Forecast lead time \Rightarrow 48 hours
- Observations assimilated: radar measurements, surface stations, buoys, ship, aircrafts, wind profilers, radiosondes and satellite observations.

AROME domain and orography



Review

MetOp combined retrieval L2 Product

Information Used:

- Temperature profiles;
- Water vapour mixing ratio profiles;
- Pressure levels;
- Surface mean elevation in the pixel;
- Quality control indicator (QCI)

Characteristics:

- Only L2 from locally received observations in Lannion.
 No MetOp-A in the evening.
- QCI temp < 2 K and QCI hum
 3 K of Td.
- Vertical Resolution: 109 levels below 10 hPa.
- Period : August, 2017 to February 28th, 2018.

L2 product X AROME - Monthly Variation

Temperature Profiles

Mean Bias and Standard Deviation:

- Agreement below 1 K in mid-troposphere.
- Larger differences near surface and between 200-300 hPa.



Dashed lines with squares - standard deviations

L2 product X AROME - Monthly Variation

Specific Humidity Profiles

- Mean Bias:
 - Near surface is negative in most cases (except December).
- Standard Deviation:
 - Absolute differences varying with seasons (actual moisture content)



deviations

Define the observation error: L2, radiosondes and aircraft X AROME (January/2018)



L2 observation error

Temperature (L2) observation error \Rightarrow 1.2 * radiosondes observation error Humidity (L2) observation error \Rightarrow 1.25 * radiosondes observation error

Review

The observation error profile





└─ Definition of data assimilation experiments

L2 data setup

Data selection procedure:

- Horizontal Thinning: select one profile over a 160 × 160 km box ;
- Vertical Thinning: 1 level every 3 levels

Filters Applied:

Region	Filter
Sea	Use data only above level 1000 hPa
Land, orography below 1 km	Use data only above level 900 hPa
Land, orography above 1 km	Use data only above level 700 hPa

Definition of data assimilation experiments

Experiments Configuration

Experiments Period: January/2018 and 22 February/2018 **Observations assimilated** : radar measurements (doppler wind and reflectivity), surface stations, buoys, ship, aircrafts (AIREP), wind profilers, radiosondes, ATMS, SSMIS, GMI, SEVIRI, ASCAT and GNSS data from ground-based station

Experiment	Configuration
Baseline	No IASI, AMSU-A and MHS data
Control	Baseline $+$ IASI, AMSU-A and MHS L1 product
L2 Experiment 1	Baseline $+$ L2 product
L2 Experiment 2	Baseline + L2 product (New observation error)

- Analysis Increment (AMF);
- First Guess and analysis departure (OMF and OMA);

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Forecast Skills.

Analysis Increment (AMF):

First evaluation : January 1st at 09 ÚTC, it represents the first analysis with a significant spatial coverage of IASI data.

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Results of data assimilation experiments

Temperature













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Results of data assimilation experiments

Profile over land and sea



Profile over land and sea



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Results of data assimilation experiments

Specific Humidity















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Results of data assimilation experiments

Profile over land and sea



Profile over land and sea



First Guess and analysis departure (OMF and OMA):

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Observations: AIREP Temperature and Radiosondes Humidity

Period1 : 2018010101 - 2018022123 Period2 : 2018010101 - 2018012723

Impact in others observations Jan-Feb(21)/2018 AIRCRAFT Temperature



Impact in others observations (01-27 January/2018) AIRCRAFT Temperature



Impact in others observations Jan-Feb(21)/2018 Radiosondes Specific Humidity



Impact in others observations (01-27 January/2018) Radiosondes Specific Humidity



 igsi Results of data assimilation experiments

Experiments Forecast Skills: Period1 : 2018010101 - 2018022123 Period2 : 2018010101 - 2018012723

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Experiments Forecast Skills - Temperature 24 hours Jan-Feb(21)/2018



Experiment is better than the reference with 95 % of confidence (t-student) Reference is better than the Experiment with 95 % of confidence (t-student)

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Experiments Forecast Skills - Temperature 24 hours Jan-Feb(21)/2018

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Experiments Forecast Skills - Temperature 24 hours (01-27 January/2018)



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Experiments Forecast Skills - Temperature 24 hours (01-27 January/2018)

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Experiments Forecast Skills - Relative Humidity 24 hours Jan-Feb(21)/2018



Experiment is better than the reference with 95 % of confidence (t-student) Reference is better than the Experiment with 95 % of confidence (t-student)

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Experiments Forecast Skills - Relative Humidity 24 hours Jan-Feb(21)/2018

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Experiments Forecast Skills - Relative Humidity 24 hours (01-27 January/2018)



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Experiments Forecast Skills - Relative Humidity 24 hours (01-27 January/2018)

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Computed the scores of precipitation X rain gauge It seems to be neutral.



Conclusion

- The L2 experiment helped to decrease the first guess and the analysis departure of the other observations.
- L2 experiment has scores comparable with the control experiment (L1 product).
- The modifications (observation error) in the L2 experiment do not cause large differences in the results. We should not keep with them.
- Next Steps:
 - Perform other periods of the year.
 - Look to the vertical resolution. Investigate the vertical distribution.
 - Try to assimilate observation close to surface. Perform a short period (3 days) to investigate if there is an improvement in the AIRCRAFT and Radiosondes OMA and OMF near surface. As we discussed in the results.

Closing Remarks

Thank you!!!